10.—Description of Panulirus cygnus sp. nov., the Commercial Crayfish (or Spiny Lobster) of Western Australia

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The Western Australian commercial crayfish has been compared with topotypical material of *Panulirus longipes* (from Zanzibar) and *P. japonicus* (from Japan) from both of which it is distinctive. It is therefore described as a new species—*Panulirus cygnus*. Notes on the biology and life history (including descriptions of the puerulus and some phyllosoma stages) are given.

Introduction

In 1934, Mr. L. Glauert, former Director of the Western Australian Museum, doubting the identification of *Panulirus penicillatus* given by Dakin (1919) for the Western Australian crayfish, sent a specimen of it to Dr. Isabella Gordon at the British Museum. After using an unpublished key of Dr. W. T. Calman, Dr. Gordon replied: "It appears to belong to *P. longipes* M. Edw." (in litt. 27.ix.1934). As a result of that identification, the name *Panulirus longipes* (Milne Edwards) 1868 has been applied to this species in fishery reports (Sheard 1949, 1954; Taylor 1956; George 1957, 1958) and for the purpose of Fisheries Regulations since that time. Some doubt about this identification was expressed by Sheard (1949, p. 10) but since he had no specimens from other localities with which to make satisfactory comparisons, he thought it "better to retain the name *Panulirus longipes* for the Western Australian commercial species". The Western Australian population is different from *P. longipes* and from all other species of spiny lobster.

Recent work by Dr. L. B. Holthuis and myself has indicated that a full revision of the *P. japonicus* - *P. longipes* complex of Palinuridae is needed. Such a revision will soon be presented jointly by us. In view of the requirements of fisheries workers for a name for the Western Australian form for use in its rapidly increasing literature it has been decided that this description be published immediately.

Genus **Panulirus** White

Marine crayfish with long flagellae on the antennules; dorsally smooth supraorbital horns, endopod of pleopod of second abdominal segment of female without stylamblys, antennal base with stridulating organ, carapace cylindrical (after Holthuis 1946).

Panulirus cygnus† sp.nov.

Panulirus penicillatus; Dakin 1919.

Panulirus longipes; Anon. 1936; Glauert 1936; Beck and Sheard 1949; Sheard 1949, 1950, 1954; Sheard and Dicks 1949; Kubo 1954 (part); George 1957, 1958; Hodgkin, Marsh and Smith 1959; Ride and Serventy 1961.

Diagnosis

A species of *Panulirus* with uninterrupted abdominal grooves each continuous with corresponding pleural groove, with unmarked reddish carapace, spotted abdomen and without endopod on pleopod of second abdominal segment of male.

Material Examined

Holotype. (Plate I) Adult male 104 mm carapace length‡, measured in the mid-line from the anterior transverse ridge between the supraorbital horns to the posterior margin of the carapace. Total length 290 mm (to end of telson) W.A.M. 90-62. Collector R. W. George 13.xi.1961.

Paratypes. 41 males (13 to 119.7 mm c.l.), 53 females (9 to 120 mm c.l.), 2 specimens sex indeterminate (8.3 and 8.4 c.l.) from between latitudes 21°45′S. and 32°16′S. at North West Cape (21°45′S. 114°10′E.), Point Cloates, Dirk Hartogs I., Abrolhos I., Geraldton, Dongara, Beagle I., Cervantes I., Green I., Lancelin I., Yanchep, Quinns Rocks, Rottnest I., Fremantle, Garden I., Point Peron (32°16′S. 115°41′E.). W.A.M. 9319, 257/60-37, 64/5-53, 40/1-58, 51-58, 53/4-58, 69-58, 91/125-62; R.M.N.H. (Leiden) D 13107.

Type locality. Radar Reef, Rottnest Island, Western Australia (32°00′S. 115°30′E.), in reef pool at depth of 1 metre.

Description of Adult

Holotype.—In addition to features characteristic of *Panulirus* described above, flagellum of exopod of third maxilliped multiarticulate (Fig. 1a) and reaches to level of middle of merus. Single uninterrupted transverse groove to tergum of each abdominal segment (Plate I) (on the basis of these two features, *P. cygnus* keys out to either *P. japonicus*, e.g. Barnard 1950, p. 547 or to *P. longipes*, e.g. Sheard 1949, p. 41 and Kubo 1954, p. 96). Antennular plate with 7 spines arranged in two posteriorly diverging rows (4 in the right row, 3 in the left row) behind the principal pair (Fig. 1d). Transverse grooves of second to fifth abdominal segments joined to and continuous with corresponding pleural groove (Plate II, Fig. 2); grooves covered by fringe of setae. Posterior half of each abdominal tergum with transverse band of short erect setae, decreasing in abundance on posterior segments. Pleopod of second abdominal segment without endopod (Fig. 1b). Mid posterior margin of thoracic sternum with pair of small teeth (Fig. 1e). Triangular plate (referred to as Plate D) at antero-lateral margin of first abdominal

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† This name was selected since the Swan is Western Australia's emblem.

‡ This measurement is hereafter characterised by the abbreviation c.l. immediately after the measurement.

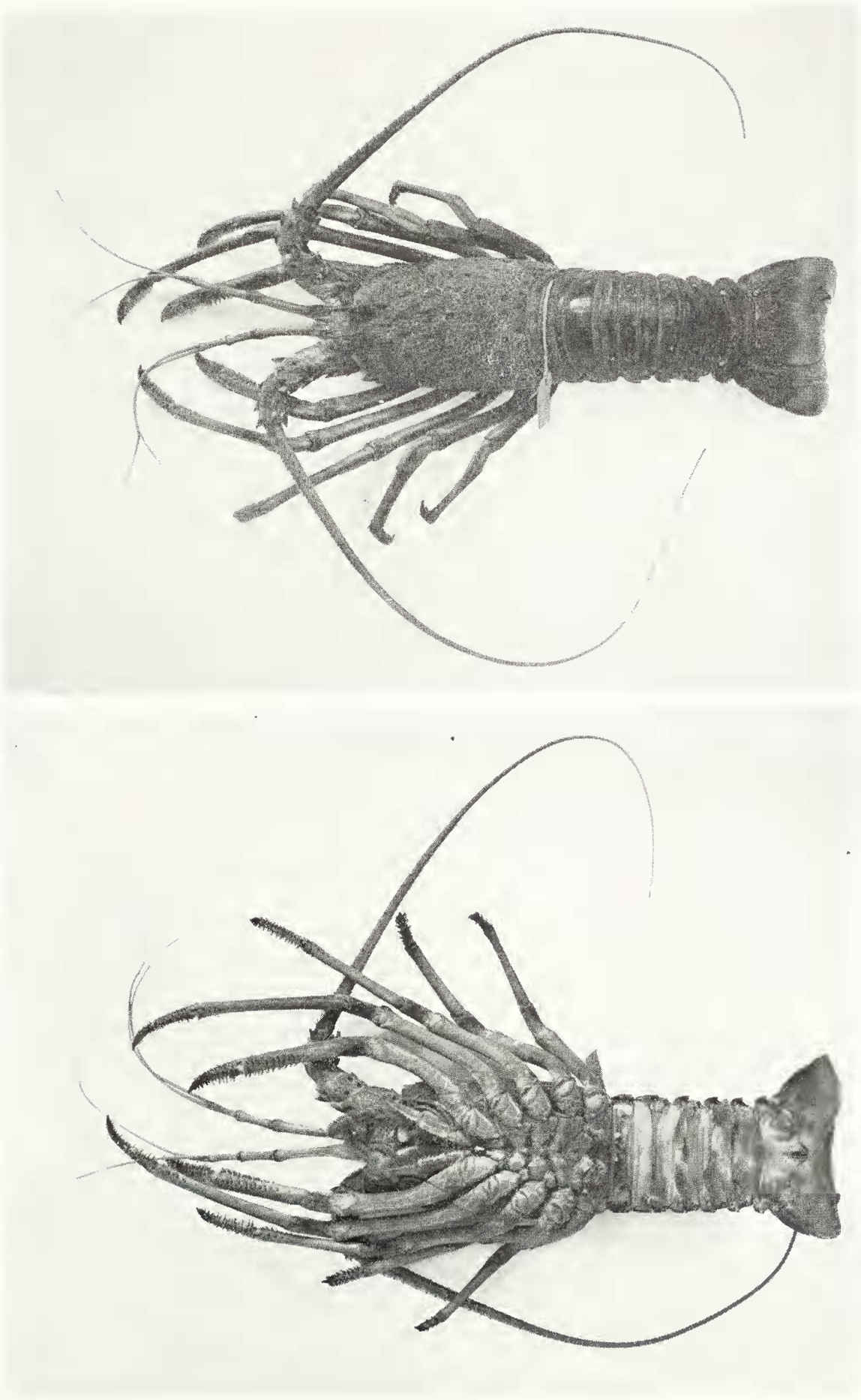


PLATE I

Male Holotype of *Panulirus cygnus* sp.nov., Radar Reef, Rottnest I., Western Australia, in reef pool, 1 metre, R. W. George, 13.xi.1961 W.A.M. 90-62 *c.* $\frac{1}{4}$ x nat. size.

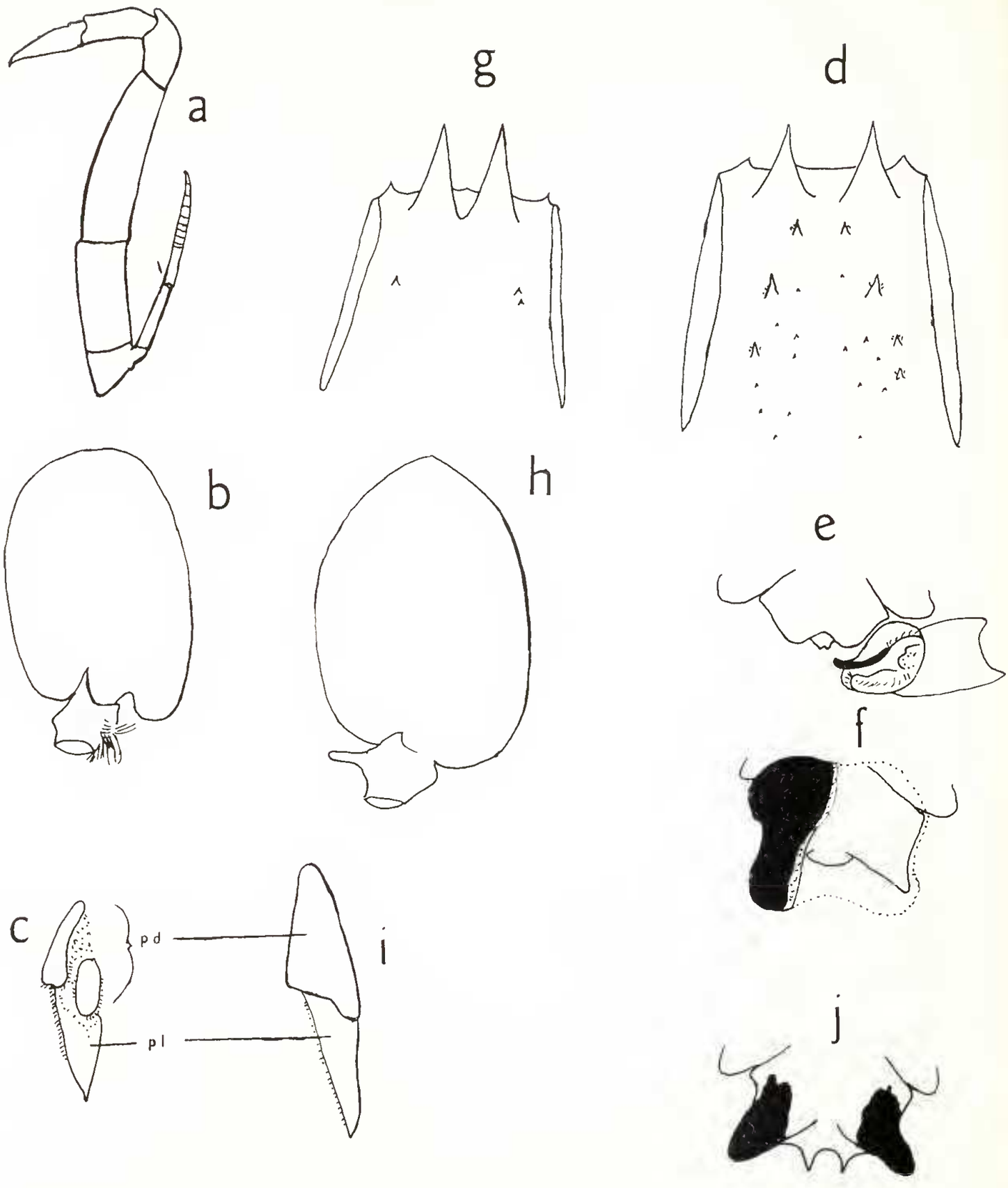


Fig. 1.—(a-e) *Panulirus cygnus* sp.nov. holotype male. (a) left third maxilliped, setae omitted, from below, *c.* nat. size. (b) left pleopod of second segment of abdomen, from behind, *c.* $1\frac{1}{3}$ x nat. size. (c) pleuron (pl) and "plate D" (pd) of first abdominal segment, from left. Note the vertical division of "plate D" by a hairy groove, *c.* nat. size. (d) antennular plate, from above, *c.* $1\frac{1}{2}$ x nat. size. (e) posterior thoracic segment, from below, *c.* $\frac{3}{4}$ x nat. size. (f) *Panulirus cygnus* sp.nov. posterior thoracic segment of mated female W.A.M. 91-62, part of spermatophore removed, from below, *c.* nat. size. (g-h) *Panulirus japonicus* (von Siebold) male c.l. 69.8 mm W.A.M. 126-62. (g) antennular plate, from above, *c.* 2 x nat. size. (h) left pleopod of second segment of abdomen, from behind, *c.* $2\frac{1}{2}$ x nat. size. (i-j) *Panulirus longipes* (Milne Edwards) mated female W.A.M. 130-62. (i) pleuron and "plate D" of first abdominal segment, from left. Note that "plate D" is not divided, *c.* $1\frac{1}{4}$ x nat. size. (j) posterior thoracic segment, from below, *c.* $\frac{3}{4}$ x nat. size.

segment divided vertically by groove containing erect setae (Fig. 1c). Carapace dark red without obvious spots or markings, abdomen spotted dorsally and laterally; each walking leg with broad pale longitudinal stripe on dorsal surface and less obvious, narrower, ventral and lateral stripes.

Variation in Paratypical Series.—In the series of 97 specimens examined, variations in the colour intensity, number of spines on the antennular plate, the two thoracic teeth, the division of Plate D, and the distribution of setae on the abdominal terga were found; these variations are associated with growth, sex or geographic distribution.

(a) Colour. The background colour varies in intensity from pink to dark red. Dark red is the usual colour for fresh specimens of all sizes, but in November and December, pale pink crayfish accumulate in the shallower waters (George 1959). These "white" crayfish do not vary from the "red" in the colour *pattern* of uniform non-spotted carapace, spotted abdomen, and broad striped legs. In alcohol, specimens may fade to yellow.

(b) Antennular Plate Spines. The total number of spines in the two main rows behind the principal spines may be 4, 5, 6, 7 or 8 in specimens larger than 30 mm c.l. All specimens smaller than 30 mm c.l. have 6 spines (3 pairs), some of which may show as sharp prominences in the position of the incipient spine. Smaller spines or tufts of erect setae may be found covering the remainder of the plate.

(c) Thoracic Teeth. In the paratypical series, the presence or absence of thoracic teeth is apparently correlated with sex and size. The puerulus stage (see p. 108) has no teeth and teeth develop subsequently so that at 20 mm c.l. all animals possess them. Males subsequently retain the thoracic teeth but females carrying a spermatophore or fibrillar pleopods do not have them (Fig. 1f). There are no specimens of mature females in the series which were collected during the non-breeding season.

(d) Plate D. Specimens in the series from localities between Point Peron, near Fremantle, and Dirk Hartogs I. and greater than 60 mm c.l. all have Plate D divided by a hairy groove as described and figured for the holotype; the depth and extent of this groove in Plate D varies in specimens smaller than 60 mm c.l., some show the hairy groove clearly, others have a very narrow, very shallow groove with sparse setae in it and others have no groove and no setae at all. None of those smaller than 20 mm c.l. have a distinct groove.

Specimens greater than 60 mm c.l. from areas north of Dirk Hartogs I. (i.e. from Point Cloates and North West Cape) do not always have the distinct hairy groove on Plate D but show the full range of variation described above for smaller sizes from the more southern areas.

(e) Setae on Abdominal Terga. The variation in this character, like that in Plate D, is best considered by separately examining the northern and southern specimens. All specimens in the series from localities between Point Peron and Dirk Hartogs I. and of greater than 70 mm c.l. have bands of setae on the posterior region of all abdominal segments although the setae on segments 5 and 6 may be sparse. Those specimens in the size range 30 to 70 mm c.l. have the bands of setae on segments 1, 2 and 3 and may or may not have them on segments 4, 5 and 6 while specimens smaller than 30 mm c.l. only occasionally have sparse setae on segments 2 and 3 but none on segments 4, 5 and 6.

The last two abdominal segments of the specimens from Point Cloates and North West Cape are without bands of setae and some of these specimens lack the setae on segments 4, 3 or even 2. In these specimens, setae on other parts of the crayfish are either sparser or absent compared with those on crayfish from the southern areas; the parts examined which bear setae are: the first joints of the antennal and antennular peduncles, the epistome and the thoracic sternum.

Comparison with Similar Species

P. cygnus sp. nov. is compared below with the most similar species of *Panulirus, P. japonicus* (von Siebold) 1824 and *P. longipes* (Milne Edwards) 1868.

Material

For the comparison with the series of *P. cygnus*, the following specimens were examined from the Western Australian Museum (W.A.M.), Queensland Museum (Q.M.) and the Australian Museum (A.M.).

P. longipes.—Topotypical Material, Zanzibar, 1 male (75 mm c.l.), 1 female (87 mm c.l.) A. J. Bruce, 21.v.1960 W.A.M. 130-62. Australian Material.* Heron I., Queensland, 2 females (92 and 100 mm c.l.) R. W. George, 25.v.1961 in reef pool, W.A.M. 129-62 and 1 male (68 mm c.l.) carapace only, R. Manning, May 1961, W.A.M. 127-62. Off Ballina, N.S.W., 1 female (110 mm c.l.) carapace only, A. Heynatz, June 1959, 120 metres W.A.M. 131-62. Evans Head, N.S.W., 1 male (110 mm c.l.) R. Paddon, 29.i.1935 Q.M. W596, and 1 female (123 mm c.l.) State Fisheries Department, December 1926 A.M. P8747 and 1 female (109 mm c.l.) State Fisheries Department, December 1931 A.M. 10169. Stockton Bight, N.S.W., 1 male (62 mm c.l.) A. A. Racek, May 1955 A.M. 13025. Japanese Material, Wakayama, Japan, E. Harada, March 1960 W.A.M. 128-62.

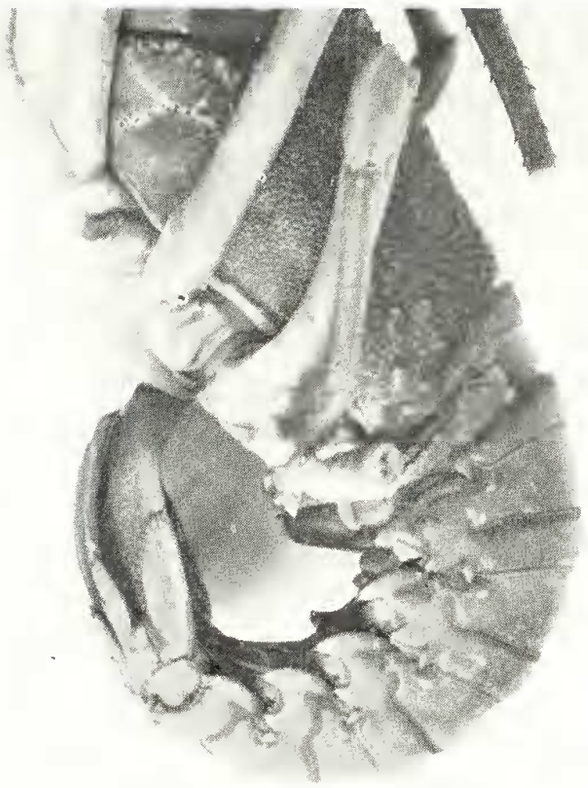
P. japonicus.—Topotypical Material. Japan, 3 males (65.7 to 69.8 mm c.l.) 3 females (48.9 to 63.0 mm c.l.) I. Kubo, 4.x.1960 W.A.M. 126-62.

Comparison

Adult specimens of *P. cygnus* are readily separated from *P. japonicus* by the following characters:

(a) The antennular plate of *P. cygnus* has 4-8 spines arranged in two rows behind the principal pair of spines (Fig. 1d.) whereas *P. japonicus* has no spines or a few very small scattered spinules in this position, (Fig. 1g).

* This and the Japanese material here assigned to *P. longipes*, differs from the topotypical material in the colour of the legs and details of the morphology of Plate D. This variation within *P. longipes* will be fully discussed by Holthuis and George in a forthcoming revision.



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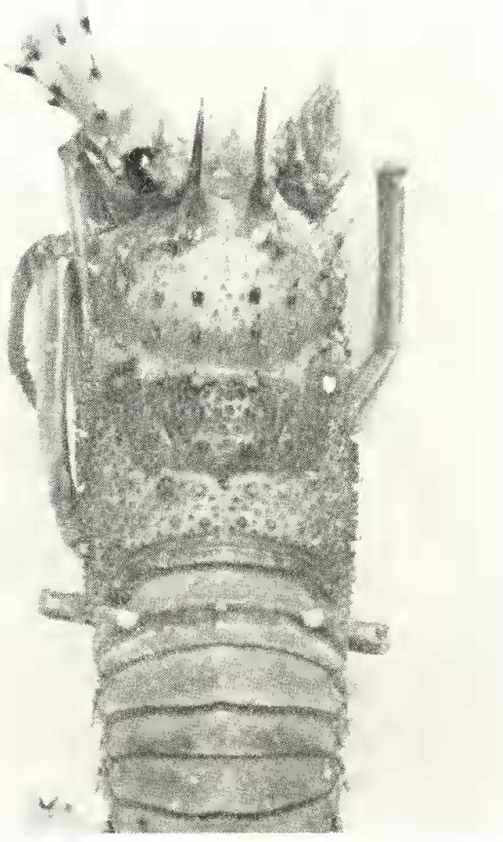

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PLATE II

Fig. 1.—*Panulirus japonicus* (von Siebold), W.A.M. 126-62 c.l. 69.8, from left. *c.* ¾ x nat. size. Fig. 2.—*Panulirus cygnus* sp.nov. holotype, from left. *c.* ½ x nat. size. Fig. 3.—*Panulirus longipes* (Milne Edwards) Japan, W.A.M. 128-62 c.l. 64.2 mm, dorsal view. *c.* ⅔ x nat. size. Fig. 4.—*Panulirus longipes* (Milne Edwards) Zanzibar, W.A.M. 130-62 c.l. 75 mm, dorsal view, *c.* ½ x nat. size.

(b) The transverse grooves of the second to fifth abdominal segments of *P. cygnus* are continuous with the corresponding pleural grooves whereas in *P. japonicus* the transverse grooves of segments 2, 3 and 4 at their lateral ends curve forward and end abruptly before reaching the pleural grooves (Plate II, Fig. 1).

(c) The male pleopod of the second abdominal segment of *P. cygnus* does not have an endopod whereas in *P. japonicus* there is a distinct endopod on that pleopod (Figs. 1b, 1h). This endopod of *P. japonicus* figured here (Fig. 1h) is nct as foliate as that of the specimen of *P. japonicus* figured by Holthuis (1946).

Adult specimens of *P. cygnus* and *P. longipes* are very similar morphologically but can be most readily distinguished by the colour pattern of the carapace. The carapace of *P. cygnus* is uniformly coloured and bears no obvious spots or markings (although the tips and ventral surface of some few spines are pale, the overall appearance nevertheless is uniform and unmarked). In *P. longipes* however, the carapace is brightly marked and spotted, the central region is darker than the anterior, posterior and lateral regions and in addition the carapace is marked by distinct pale spots distributed over it and the dorsal surface of supraorbital horns; there is also a longitudinal pale mark on the side of the carapace leading back from the post-antennal spine towards the cervical groove. A bow-shaped pale mark demarks the posterior margin of the dark central region. (Plate II, Figs. 3 and 4).

In addition to these colour markings, three morphological features, although variable, are useful in the separation of *P. cygnus* and *P. longipes*.

(a) In adults of both sexes of *P. longipes*, there are two sharp spines on the posterior margin of the thoracic sternum (Fig. 1j) whereas in *P. cygnus* adult females have no spines (Fig. 1f) and in males the two teeth are only poorly developed (Fig. 1e).

(b) The triangular Plate D of the first abdominal segment is fully divided by a vertical hairy groove in most *P. cygnus* (Fig. 1c) whereas in *P. longipes* it is usually not divided (Fig. 1i).

(c) *P. cygnus* usually has a band of setae across the posterior half of each abdominal tergum between the transverse groove and the posterior margin whereas in *P. longipes* only the first segment shows a band of setae. (Plate II, Figs. 2, 3 and 4).

There is one obvious difference between the specimens of *P. longipes* from Zanzibar and those from Japan and eastern Australia. This is in the colour pattern on the legs. The Zanzibar specimens have the dorsal surface of the merus of the legs ornamented with a thin white stripe which is interrupted along its length by three distinct white spots (Plate II, Fig. 4); the merus of the legs of the Japanese and eastern Australian specimens have an unbroken thin white stripe on the dorsal surface (Plate II, Fig. 3).

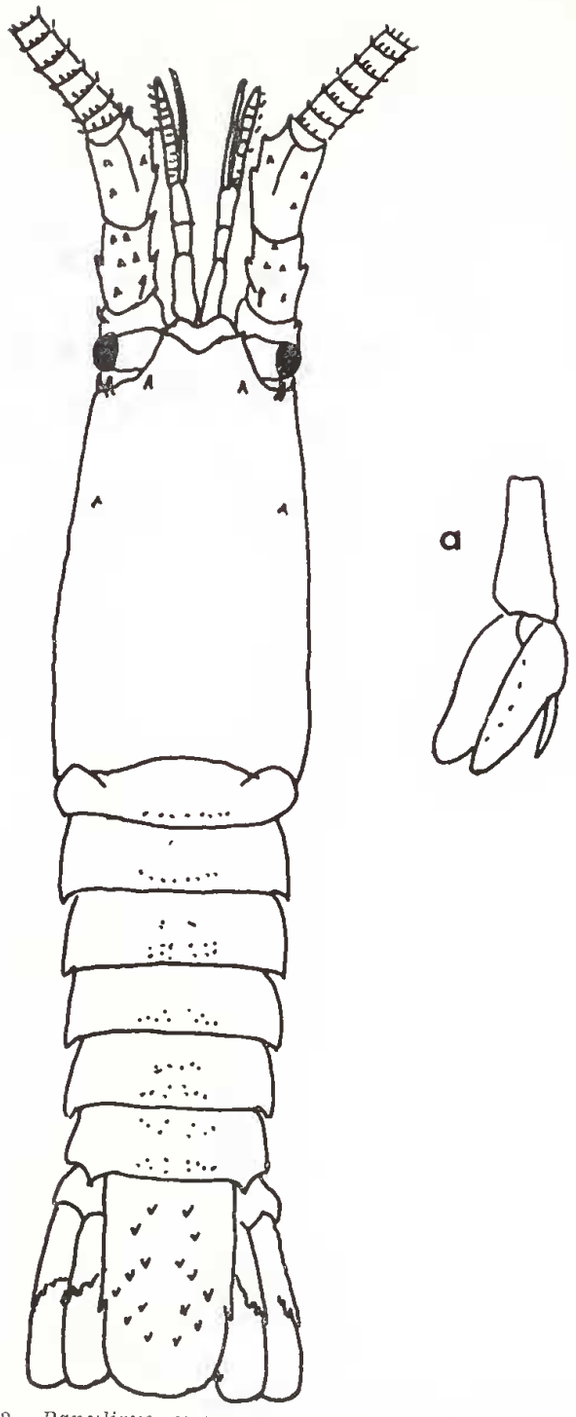

Fig. 2.—*Panulirus cygnus* sp. nov. puerulus stage 22.5 mm t.l., (a) pleopod, further enlarged and setae omitted.

Descriptions of Puerulus and Phyllosoma

Puerulus of P. cygnus (Fig. 2)

Thirty one specimens, (8 to 9 mm c.l., 21 to 24 mm total length) of the puerulus stage of *P. cygnus* are in the collection of the Western Australian Museum. (W.A.M. 66-58 to 68-58, 77-62 to 89-62) from the following localities: Maud Landing, Dirk Hartogs I., Abrolhos Is., Geraldton, Beagle I., Lancelin I., and Garden I. These were collected from craypots after they had fallen to the decks of crayfishing vessels. All were collected between the months of October and May.

Description.—Carapace dorso-ventrally compressed with two lateral carinae, each terminating anteriorly at a spine. Posterior half of carapace without spines, anterior region with one

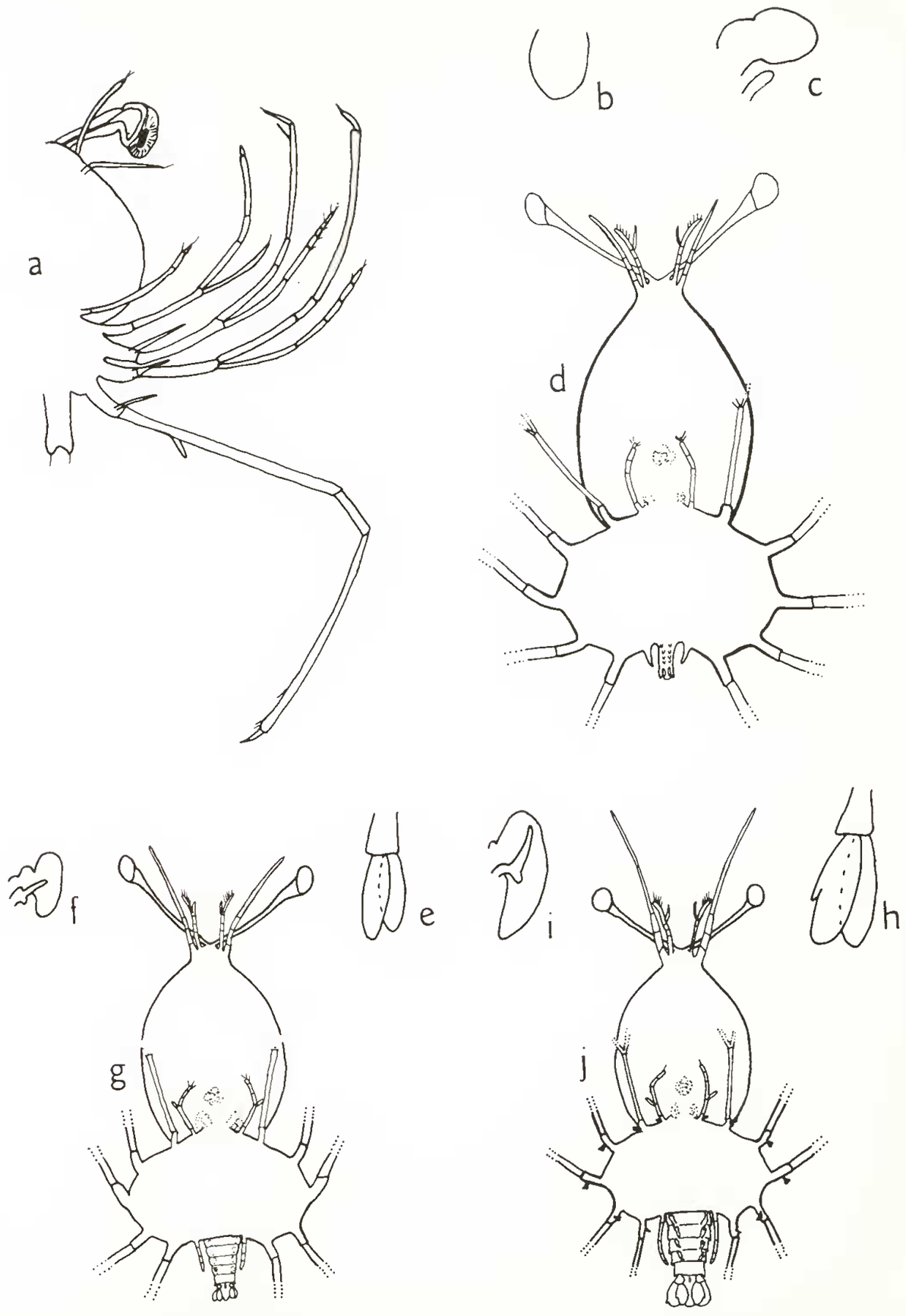

Fig. 3.—*Panulirus cygnus* sp.nov. phyllosoma stages (a) Stage I. 1.3 mm t.l. (b-d) Stage VIII. 16 mm t.l. (b) pleopod and (c) second maxilla and first maxilliped, further enlarged. (e-g) Stage X. 25.5 mm t.l. (e) pleopod and (f) second maxilla and first maxilliped, further enlarged. (h-j) Stage XI. 32 mm t.l. (h) pleopod and (i) second maxilla and first maxilliped, further enlarged.

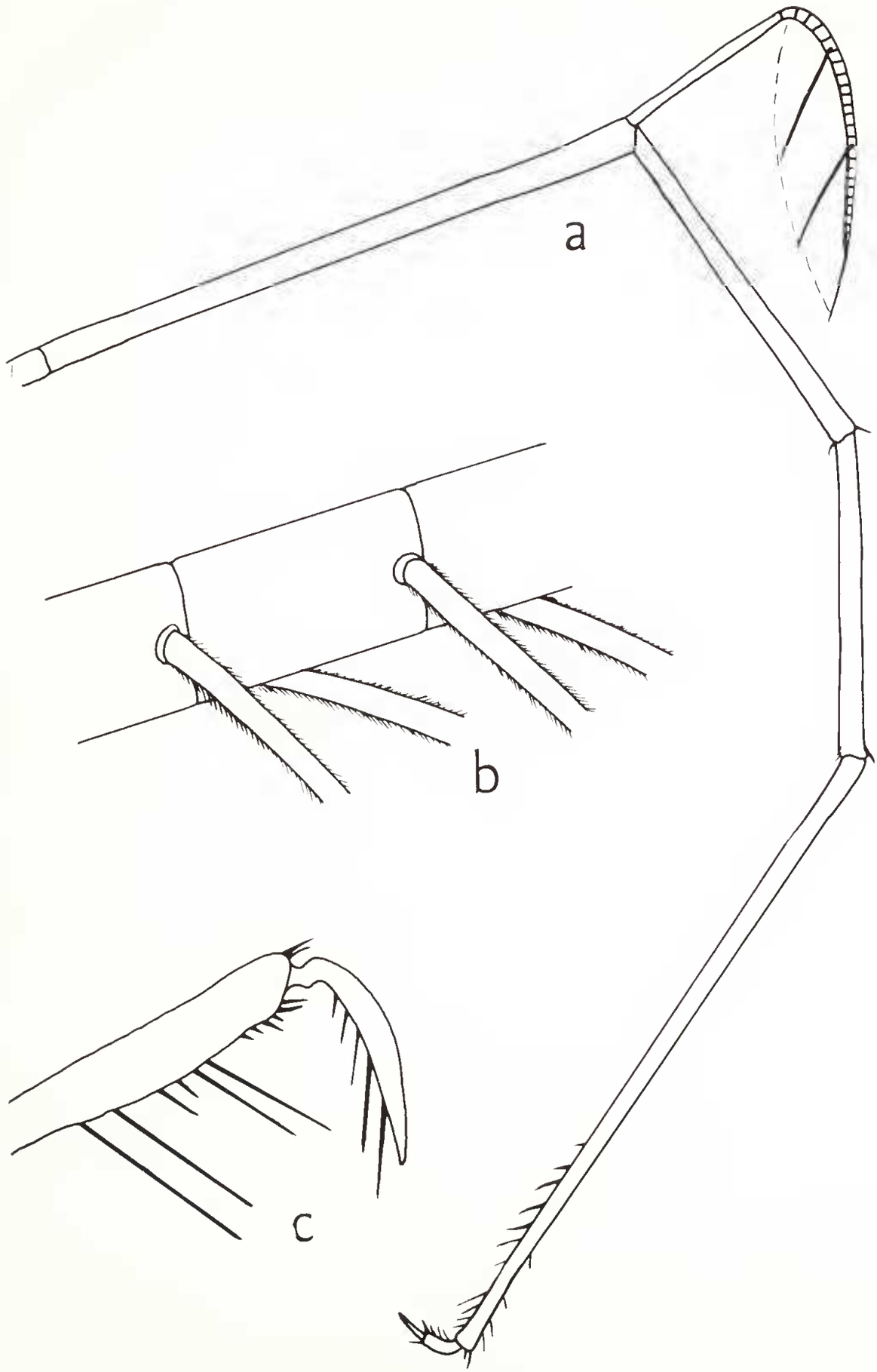

Fig. 4.—*Panulirus cygnus* sp.nov. phyllosoma Stage VIII (a) first pereiopod, only 3 satae of exopod represented, *c.* 5 x nat. size. (b) first pereiopod, detail of exopod segments and plumose setae, *c.* 35 x nat. size. (c) second pereiopod ?, distal portion of propodus and dactyl, *c.* 15 x nat. size.

pair of depressed conjoined supraorbital spines, one pair of spines behind these, one pair behind the eyes and one pair at antero-lateral angles of carapace. Antennae gradually tapered to tip, slightly longer than total length of body (antennae 1.02 to 1.14 times total length). Tergum of antennular plate small, without spines. Posterior margin of thoracic sternum smoothly concave without teeth.

Abdominal terga without transverse grooves; pleura of segments 2 to 6 terminate in single posteriorly recurved spines. Each pleopod biramous, setose along margins and with appendix interna on endopod.

Exopod of third maxilliped uniarticulate, extends at least to base of merus. Exopod of second maxilliped reaches distal end of carpus. Perciopods more or less uniform in length, without trace of exopods.

Live specimens are transparent, preserved specimens opaque or light brown. Sexes at the puerulus stage are externally indistinguishable.

Phyllosoma of P. cygnus

A detailed investigation of the morphology and distribution of larval stages of *P. cygnus* has been commenced with the support of the Commonwealth Development Trust Fund and the co-operation of the State Fisheries Department. It is clear that a great extension to our knowledge will result from this investigation but the results will not be available for some time: in the meantime, preliminary descriptions of some stages are presented.

Eleven separate phyllosoma stages have been recognised for other species of *Panulirus* (e.g. Lewis 1951; Johnson 1956, 1960; Prasad and Tampi 1959). For *P. cygnus*, four separate stages (I, VIII, X, XI) are here described and the stage numbers which have been allocated to these specimens are assigned after comparison between these and the published descriptions of those other species.

Except for the first phyllosoma specimens which were recovered direct from a spawning female, all four late stage specimens were taken during the hours of darkness even though 37 daytime surface hauls were made compared with 22 night-time surface hauls over the two year sampling period.

Phyllosoma Stage I (Fig. 3a).—Several specimens of this first larval stage were obtained on two separate occasions; hatched from a captive egg-bearing female, and collected directly from the eggmass of another.

Description.—Body flattened, fore-body wider than hind-body, abdomen short and butted to hind-body. Antennae and antennules uniramous, each equal to total length of eye. Stalk of eye thick, unsegmented; eye large. Second maxilliped uniramous, third maxilliped with unsegmented exopod. First and second pereiopods with long coxal spine and segmented exopod. Third pereiopod with long coxal spine and short exopod bud. Total length 1.25 to 1.5 mm measured from anterior margin of fore-body to extremity of abdomen.*

When first hatched from the egg capsule, this first phyllosoma stage differs in some minor respects from the phyllosoma as described above. It is smaller (1.0 to 1.2 mm t.l.), globose, with the appendages and eyes closely folded against the body. The coxal spines and setae of the wrinkled and shorter legs are not apparent. It gives the general appearance of a somewhat "deflated" stage I phyllosoma.

Recently hatched specimens (presumably in this larval condition) were referred to by Sheard (1949) as "Naupliosoma" but here they are regarded as early phyllosoma stage I. These could rapidly develop into the condition described above by becoming turgid, thus increasing the size of body and legs, and extruding the spines on the coxae and on the exopodites of the pereiopods. The "naupliosoma" is not here regarded as a distinct stage separated by a moult.

Phyllosoma Stage VIII (Figs. 3b-d and 4).—A single specimen was collected in an N70 plankton tow net at surface 30 miles N.W. of Jurien Bay, W.A., on 3.ix.1957 at 0225 hours, W.A.M. 10-59.

Description.—Fore-body pear-shaped, narrower than hind-body. Antenna and antennule of equal length and two-third total length of stalked eye. Third maxilliped and first to fourth pereiopod with setose exopods (Fig. 4); fifth pereiopod present as a single joint. Second maxilliped without exopod. Appendages without gills or coxal spines. First maxilliped and second maxilla are shown in Fig. 3c. Abdomen parallel sided, unsegmented and butted to slightly concave margin of hind-body. Four pairs of pleopods present as simple lobes (Fig. 3b). Uropods free, bilobed without lateral spines. 16 mm, t.l.

Phyllosoma Stage X (Fig. 3e-g).—A single specimen was collected in an N70 plankton net at surface, 65 miles west of Fremantle, W.A., on 26.xi.1956 at 2300 hours. W.A.M. 8-59.

Description.—General body shape as for stage VIII. Antenna twice length of antennule and equal to total length of stalked eye. Third maxilliped and first to fourth pereiopods with setose exopods; fifth pereiopod uniramous, four jointed. Second maxilliped with small exopod bud. Appendages without gills. First maxilliped and second maxilla are shown in Fig. 3f. Abdomen segmented with four pairs of bifid pleopods (Fig. 3e). Uropods biramous with external lateral spine on each ramus. 25.5 mm t.l.

Phyllosoma Stage XI (Fig. 3h-j).—Two specimens were collected with the stage X specimen above. W.A.M. 7-59.

Description.—Antenna two and one half times length of antennule and one and one half times total length of stalked eye. Fifth pereiopod uniramous with four well defined segments. Second maxilliped with well defined exopod. Second and third maxillipeds and first to fourth pereiopods with two or more gills. First maxilliped and second maxilla are shown in Fig. 3i. Abdomen segmented with four pairs of biramous pleopods, showing rudiments of appendix interna (Fig. 3h). Uropods biramous, well developed, with external lateral spine on each ramus. 32 mm t.l.

* This measurement of phyllosoma is hereafter indicated by the abbreviation t.l.

Distribution of P. cygnus

P. cygnus occurs along the entire west coast of Australia from North West Cape (21°45'S.) to Hamelin Harbour (34°30'S.). The main fishing areas are between Shark Bay and Rottnest I. on the inner terraces of the Rottnest and Dirk Hartogs Shelf (see Carrigy and Fairbridge 1954 for definition of these terms). Animals are common in depths of 0-90 metres and specimens have been taken at 120 metres. During the day they shelter in the crevices and cavities of either reefs or coraline limestone, living coral or submerged aeolianite.

Other palinurid species occur only rarely in the range of *P. cygnus*. *Jasus lalandei* (Milne Edwards) 1837 is occasionally taken on the lower west coast (e.g. at Rottnest I. and Hamelin Harbour); in the northern part of the west coast (e.g. at North West Cape), *Panulirus versicolor* (Latreille) 1804, *P. ornatus* (Fabricius) 1798, *P. homarus* (Linnaeus) 1758, and *P. penicillatus* (Olivier) 1791 are known to occur.

The maximum and minimum water temperatures experienced in the area inhabited by *P. cygnus* are 27°C—the February maximum at North West Cape—and 16°C—the August minimum at Hamelin Harbour (Sverdrup *et al.* 1942). Vaughan (1940) recognised and named five water temperature zones and in accordance with his terminology, *P cygnus* inhabits the "subtropic temperature zone".

Feeding Habits of P. cygnus

P. cygnus is omnivorous, foraging at night on reefs, wave cut platforms and general areas adjacent to its daytime shelter. In January and February 1956, seventeen specimens were caught at Radar Reef, Rottnest I. while actively feeding on the reef flat at night. The stomachs were examined and these contained fragments of *Ulva* sp., *Lithothamnion* sp., annelids, sipunculids, small gastropods, small crustacea and echinoid spines. On one occasion, *P. cygnus* was observed eating the foot of the large limpet *Patellanax laticostata* Blainville 1825 in the shallow water on a reef flat.

Reproduction of P. cygnus

Mated females are readily recognised by the black butterfly-shaped spermatophore which covers the last two thoracic segments.

As far as is known, eggs are fertilized externally by spermatozoa which escape from the spermatophore. After fertilization, the orange eggs adhere in bunches to long filaments of the pleopods and females with eggs attached to these filaments have the surface of the spermatophore eroded. This erosion presumably allows the escape of spermatozoa at the time of fertilization and is almost certainly caused by the claw on the fifth leg of the female.

Recently mated females are first observed about July and in the Rottnest areas females with eggs beneath the abdomen are found during the summer months (November to February).

Once adult females have mated, they do not moult until the eggs on the pleopods have completed their development and the first stage phyllosoma have been released. Moulting of adult females occurs twice each year, just before mating (about June), and just after larval release (about March). Adult females examined in the field between July and February possess long filaments on the pleopods whereas those examined between March and June have very short filaments on the pleopods.

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